

Finally, the results which flow from these figures can be seen at a glance in fig. 5, herewith. Remembering that the monthly means relate to the middle of the month, we see that throughout the whole Isthmus the rainy season begins immediately after May 1, but that soon the rains decrease on account of the northward advance of the layer of rising air. This diminution takes place in July in the interior of the Isthmus, but is subject to a delay of one month on the Pacific side and of two months on the Atlantic side. A second maximum in the rainfall occurs at the end of September in the interior, but at the end of October on the Pacific coast and in the middle of November on the Atlantic coast. Then comes the dry season, which, everywhere on the Isthmus, begins about the 1st of January and continues for four months, on account of the southward return movement of the ascending layer.

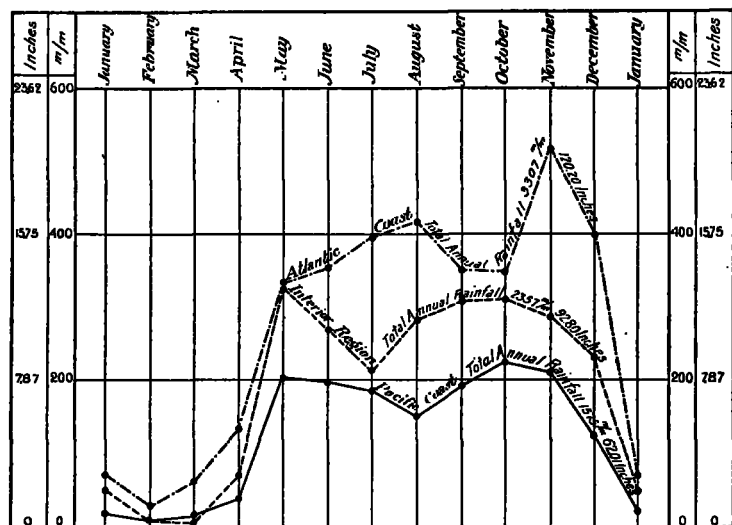


FIG. 5.—Total monthly precipitation on the Isthmus of Panama. These curves are based on the following data: For the Atlantic coast one station, Colon, for 15 years. For the Pacific coast three stations, La Boca, 1 year; Naos, 8 years; Panama, 4 years; total, 13 years. The interior of the Isthmus four stations, Gorgona, 2 years; Gamboa, 15 years; Bas Obispo, 10 years; Culebra, 5 years; total, 32 years.

These two periods of heaviest rains do not differ much from each other as to the maximum volume of water, except on the Atlantic coast, where the second period has a greater quantity of rainfall; but it must be particularly noted that the total quantity of precipitation is far from being the same everywhere. The figures are given in the following table.

TABLE 21.—Annual precipitation, in inches.

Section and station.	Length of record, years.	Maximum.	Minimum.	Mean.	General mean.
Atlantic coast:					
Colon	15	154.89	116.36	130.20	130.20
Interior region:					
Gorgona	2	.....	.....	99.77	92.80
Gamboa	15	196.58	71.65	96.54	
Bas Obispo	10	123.08	76.69	89.29	
Culebra	5	98.98	64.25	85.07	
Pacific coast:					
Panama	4	84.73	45.59	66.77	62.01
La Boca	1	.....	.....	73.70	
Naos	8	66.06	64.49	45.98	

These facts show that all the most difficult works of the Panama Canal, except, perhaps, the locks and the dam of Bohio, are situated in the interior or near the Pacific, where the rains are not very violent. Although the quantity of rainfall is large it is quite comparable with what is to be found in the United States near the Gulf of Mexico. Thus, the observations for many years give the following comparisons:

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Station.	Number of years.	Mean precipitation.	Annual maximum.
New Orleans, La.	28	Inches. 51.18	Inches. 67.33
Mount Vernon Arsenal, Ala.	15	66.14	106.69
Baton Rouge, La.	15	59.45	116.54
Isthmus of Panama:			
Interior	33	92.91	196.61
Pacific coast	13	61.81	84.66

APPENDIX.

By A. J. HENRY, Chief of Division, Weather Bureau.

The following contains additional tables of rainfall for the Isthmus of Panama, compiled from manuscript and other records now in the archives of the Weather Bureau.

The observations at Colon, 1862 to 1874, were made by Drs. W. T. White and J. P. Kluge, surgeons of the Panama Railway Company. Those for 1893–95 were kept by O. B. Schaffer, C. E., Panama Railway.

The record for Taboga Island, 1861–66, is drawn from a report on interoceanic ship canals, page 29, published as Senate Ex. Doc. No. 75, Forty-fifth Congress, 3d Session.

It is proper to state that the officials of the Panama Railway Company have been asked to furnish a complete record of rainfall made by the officers of the Company at Panama, from the beginning of observations in 1862 to the present time.

TABLE 22.—Precipitation at Colon.

Year.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Annual.
1862 ..	.....	2.94	0.85	.....	13.09	15.32	35.76	10.34	15.84	13.10	43.01	18.83	.....
1863 ..	1.75	0.77	0.78	0.44	15.87	5.78	.....	13.37	17.85	11.23	17.59	15.21	.....
1864 ..	1.90	0.02	3.89	9.22	16.85	9.61	18.39	8.55	9.69	22.16	6.58	107.4	.....
1865 ..	[1.10]	1.08	0.21	4.07	14.76	12.17	16.72	12.72	18.32	15.04	21.72	8.42	129.7
1866 ..	3.99	1.07	0.48	1.30	11.88	8.85	16.08	19.82	5.35	20.50	.....	.....	.....
1867 ..	1.58	0.80	2.18	0.87	7.24	18.11	20.80	12.50	16.16	13.13	21.58	3.72	190.0
1868 ..	11.17	2.77	4.95	5.04	6.72	10.68	18.22	14.02	8.98	14.82	24.13	10.10	114.8
1869 ..	0.83	3.33	4.85	6.46	20.35	12.48	15.60	16.35	6.74	11.21	32.42	14.85	149.6
1870 ..	4.30	0.53	0.05	1.52	1.68	7.70	23.27	11.56	8.00	12.58	12.38	4.94	99.6
1871 ..	15.42	0.78	0.63	1.30	21.42	22.00	19.90	19.97	16.30	30.32	19.11	13.12	168.5
1872 ..	3.57	0.33	0.13	2.18	3.92	13.20	12.50	10.69	10.91	14.30	11.77	0.94	87.1
1873 ..	6.33	0.25	3.14	18.02	8.92	15.87	18.02	17.28	8.32	16.65	20.62	7.89	137.7
1874 ..	5.33	1.34	3.94	18.02	8.92	15.87	18.02	17.28	8.32	16.65	20.62	7.89	137.7
1893 * ..	1.78	3.86	1.81	8.05	6.65	12.94	11.44	15.10	9.92	12.38	17.78	30.94	131.90
1894 ..	5.35	1.69	0.36	2.18	9.84	12.24	19.05	22.02	18.79	13.43	23.66	25.12	153.76
1895 ..	3.86	1.82	2.03	22.36	16.17	9.26	17.10	14.15	12.11	16.47	.....	.....	.....

* O. B. Schaffer, C. E., Panama Railway. See M. W. R., 1898, page 363.
† One day missing.

[Mr. C. F. Talman, Weather Bureau Observer at Colon, reports that the rainfall for Colon in 1895, as published in the MONTHLY WEATHER REVIEW, 1898, p. 352, and 1899, p. 203, differs in some cases from the records in the office of the Panama Railroad Company at Colon, which, he states, reads as follows: 1895, April, 21.96 (not 22.36); May, 18.14 (not 16.17); September, 12.10 (not 12.11). No explanation of these differences is known.—Ed.]

TABLE 23.—Precipitation at Taboga Island.

N. 8° 48', W. 79° 32'; altitude 10 feet.

Year.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Annual.
1861 ..	0.00	0.00	0.00	2.16	14.30	10.91	8.27	4.30	8.87	11.19	5.23	6.76	71.99
1862 ..	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
1863 ..	0.00	0.00	0.00	0.26	1.60	8.80	8.11	9.54	11.94	1.62	2.87	3.77	48.51
1864 ..	0.50	0.00	0.00	0.00	3.13	4.78	2.08	5.91	8.60	11.38	2.97	11.42	45.72
1865 ..	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
1866 ..	.....	.....	.....	.....	.....	.....	.....	8.74	4.90	5.16	5.12	4.30	.....

SPURIOUS TORNADO PHOTOGRAPHS.

By Mr. ALFRED J. HENRY, Chief of Division.

We have watched with interest and curiosity the efforts of some manipulators of the camera to reproduce the phenomena of nature in all her varying moods. There can be no particular fault found with the enterprise of the photographer, be he amateur or professional, who sallies forth at high noon, or soon thereafter, and under the friendly shadow of an accommodating cloud makes moonlight views by the score. We confess, too, that we can pass into the waste

basket without hesitation the many poor attempts to fabricate the funnel cloud of a tornado. We received one such not very long ago from Mr. Connor. It was better than the average, and instead of going into the trash basket it went into a convenient drawer. Now we are glad that we kept it, for along comes a photograph kindly sent us by Mr. Gosewisch, of the tornado cloud that brought death and destruction to so many homes in Kirksville, Mo., on April 27, 1899.

We thought we had seen that tornado cloud before, and the more we looked at it the more certain we were that we had met an old friend. When we first saw it our funnel cloud was stirring up the dust and incidentally frightening the inhabitants of Waynoka, in far-off Oklahoma, and this was more than a year ago. The scene has now changed to a quiet road in Missouri across which our Oklahoma tornado cloud appears to be crossing, while a couple of artistic Rubens watch its progress in wonder and amazement. The job is well done. There is no particular fault to be found either with the conception or the execution, but it pains us to think that people will take such liberties with the business end of a tornado. Only to think, "It was taken at 100 yards!" We sincerely hope that the pioneer who "took it at 100 yards" will some day meet a real robust tornado.

For the edification of the readers of the MONTHLY WEATHER REVIEW we print the two pictures on Plate I. On the left-hand is the Waynoka picture, on the right-hand is that for Kirksville. The Waynoka tornado is mentioned at page 201 of the REVIEW for May, 1898, where it is said to have begun about 6:30 p. m., central time, about 3 miles west of Waynoka, on Tuesday, May 17. The date, May 24, given on the back of the Waynoka photograph is probably an error of one week.

It is possible that the Waynoka picture was made by superposing a tornadic funnel upon a beautiful photograph of sunset clouds and landscape. The Kirksville picture retains the funnel and clouds of the Waynoka picture, but substitutes a view of a road and its osage hedges, such as might occur in Missouri. But where did the original funnel come from? It is evidently not a photograph from nature of a genuine tornado funnel. It has every appearance of having been drawn in india ink on glass and then photographed by printing upon the landscape negative. The retouching of original negatives so as to convert a portrait from nature into a beautiful work of art is carried on in great perfection by modern artists, but any application of this art to photographs that are to be used for scientific purposes does more harm than good.

The latest turn in the history of this picture has been given by its publication in the Philadelphia Press of Sunday, June 23, 1899, where our Kirksville picture with its Missouri landscape appears as "the Waynoka tornado of May 18, 1898, at about 1,000 feet distance." This change of distance would seem to have been necessitated by the perspective distance inherent in the beautiful Missouri landscape; the change of date is possibly a misprint.

We shall doubtless see the Waynoka clouds and funnel reproduced again, at no distant date, in connection with some other dreadful disaster. The argument seems to be: "If there was a disaster, it must have been a tornado; if a tornado, it must have had a funnel; if a funnel, there must be a picture; this is a photograph, therefore it will do."

THE METEOROLOGICAL SERVICE OF CANADA.

By Prof. R. F. STUPART, Director.

The Meteorological Service of Canada is an organization maintained by the Dominion Government and is a branch of the Department of Marine and Fisheries.

The work of the Service comprises the issue of weather

forecasts for the benefit of shipping, fishing, and agricultural interests, the collection of climatological data for purposes of agriculture and the information of immigrants, etc., and scientific meteorological research.

There are now in the Dominion 304 stations at which observations are taken with instruments supplied by the Government and which report to the Central Office, Toronto. They are divided as follows: 4 first order, 65 second order, 206 third order, and 89 rainfall stations.

At Banff, in the Rocky Mountains at an altitude of 1,384 meters, there is at present a station of the second order, and within the next year it is hoped that we shall be able to establish a station with self-recording instruments on the top of Rundle Mountain within a few miles of Banff at an altitude of 2,921 meters. Thirty-seven stations report by telegraph twice daily, and two stations, St. Johns, N. F., and Bermuda once daily; these two latter although not in the Dominion are maintained by the Dominion Government. Almost invariably all reports from stations between Lake Superior and Cape Breton are received in the Central Office by 8:30 a. m. and p. m. and then forwarded without delay to the United States Weather Bureau at Washington via Buffalo, N. Y., from which place some 60 United States stations are in return sent to Toronto, together with the Canadian reports from Manitoba westward to British Columbia. All reports are usually received shortly after 9:30 and the working chart is ready for the forecasting official by 9:45, and by 10 o'clock the isobars have been drawn and some of the forecasts telegraphed to their destination. The bulletin issued at night comprises a short synopsis of the weather during the past day and generally a description of the existing meteorological conditions, then a list of the highest and lowest temperatures recorded at about a dozen stations, followed by the forecasts for the various districts lying between Manitoba and the Maritime Provinces. These forecasts are for the twenty-four hours beginning at the following 8 a. m. unless it be expressly stated that they cover a longer period. That same evening the telegraph company sends the bulletin to all points where morning newspapers are published, in which it is generally printed at the head of the column of local news, and then in the morning on the opening of the various telegraph offices throughout the Dominion the first message which goes over the wires is the daily forecast, which is posted up in a conspicuous place in every telegraph office. Up to the summer of 1894 the forecast based on the 8 p. m. was practically the only one issued, but since that time a second forecast covering the current and following day has been issued at 10 a. m. This is sent to nearly all ports, both on the Great Lake and on the seaboard, and arrangements have recently been made whereby it appears in most of the afternoon newspapers published in the Dominion.

There are in the Dominion 70 stations at which cautionary and storm signals are displayed—32 on the Lakes and 38 in the Maritime Provinces. The signals used are drums and cones, the cone alone being hoisted when but a moderate gale is expected, and both drum and cone together when it is thought that the storm will be heavy. The apex of the cone downward indicates southerly and easterly directions and upward northerly and westerly.

As a means of disseminating more generally the forecasts among the farming community during the summer season, white discs, indicating "fine," "showers," or "rain," are placed each afternoon on the baggage vans of outgoing trains, being the forecasts for the next day.

Each morning some seventy-five copies of the weather chart are made by means of a duplicating machine, the mimeograph, and supplied to a few subscribers, to the Toronto newspapers, to the board of trade, and to such business people who engage to post them where they will be seen by the public.



Waynoka, Okla., May 17, 1898, 6:30 p. m.



Kirksville, Mo., April 27, 1899.